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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/924,209	08/07/2001	Sarath D. Gunapala	06618-379002	1843

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EXAMINER

BAUMEISTER, BRADLEY W

ART UNIT

PAPER NUMBER

2815

DATE MAILED: 07/28/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.
09/924,209

Applicant(s)
Gunapala et al.

Examiner
B. William Baumeister

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on May 12, 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above, claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on May 12, 2003 is: a) ☐ approved b) ☒ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
*See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____ 6) ☐ Other: _____

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DETAILED ACTION

Specification

1. The amendment filed 5/12/2003 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: the Brief Description of the Drawings section has been amended to now set forth particular integrated values $|E_z|^2$ for the electric fields E_z depicted in each of Figs 4 through 6. These newly stated values are not supported by the specification as originally filed.

Applicant is required to cancel the new matter in the reply to this Office Action.

Drawings

2. The corrected or substitute drawings were received on 5/12/2003. These drawings are **not** approved. Specifically, Applicant has amended Fig 3 to label the previously unlabeled white serpentine region that is positioned between the grating teeth and the quantum well stack as element 116.¹ The specification and Fig 1 indicates that element 116 is the doped-GaAs contact

¹In the response, Applicant requests substitution of the prior drawings with a new set of formal drawings incorporating the marked changes (Amendment C, page 8). However, no marked-up copy of the drawings is present in the application file wrapper. The Examiner notes for the record that the only substantive change to the drawings appears to be the further inclusion of the label 116 in FIG 3.

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layer. If this is what Applicant in fact intended, it is unclear how the contact layer is formed in the serpentine configuration of FIGs 3-5 in light of the specification's teaching that the diffraction slits 120 are formed after the formation of the contact 116. An appropriate drawing correction or clarification of this issue is required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
4. Claims 1-3, 5-8 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Choi '015 (previously made of record) in view of Chen et al., "Corrugated Quantum Well Infrared Photodetectors with Polyimide Planarization for Detector Array Applications," IEEE Transactions on Electron Devices, Vol. 45, No 7, July 1998, pp. 1431-1437 (previously made of record).
 - a. Choi '015 discloses quantum grid infrared photodetectors (QGIPs) wherein diffraction slits 251 are etched into the (Al)GaAs MQW detector region to form single-slit diffraction units. The presence of the diffraction slits improves the sensitivity of the IR detector by coupling more incident radiation into the detector relative to that of a convention quantum well infrared photodetector (QWIP) which does not possess the slits. Specifically, Choi teaches that

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the sensitivity is greater than prior art QWIPs because in QGIPs “the optical area includes both the etched and un-etched areas (i.e., the areas of stacks S including cavities 251), while the detector are only includes the un-etched areas of stacks S. Because photocurrent is directly proportional to the optical area, and the dark current, which produces noise, is directly proportional to the detector area, detector sensitivity increases when the detector area is reduced without reducing the optical area, as is the case of the present invention.” (Col. 8, lines 52-62). Choi also teaches that the diffraction slits may be formed either by plasma etching wherein the cavity sidewalls are straight (e.g., FIGs 5 and 9 and col. 6, lines 40-) or alternatively by wet etching wherein the cavity sidewalls form a pyramidal slope in one crystal direction and an inverted pyramidal slope in the orthogonal crystal direction (e.g., Figs 13-15 and col. 9, line 19-). Choi does not anticipate the claims because the reference teaches 1-dimensional (1-D) slits (e.g., FIG 6) as opposed to 2-dimensional slits (i.e., isolated columns) as set forth in the independent claims.

b. Chen teaches GaAs-based corrugated quantum well IR photodetectors (C-QWIPs) formed on a transparent substrate and having either 1-D V-grooves or alternatively 2-D V-grooves producing fully-isolated, diffractive-grating detector pixel columns, each comprising a lower contact layer, a MQW detection region and an upper contact layer. A metal contact is formed over the top contacts. (See e.g., Fig 1, showing the 1-D slit embodiment). Further, Chen discloses that the lower contact is overetched (e.g., p. 1434, col. 2), indicating that the lower contact also extends into the column. The grooves are filled with an insulating material such as

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polyimide. The refractive index of GaAs is 3.1 and that of polyimide is 1.6 (p. 1434, col. 2).

Chen does not anticipate the claims because the reference only teaches the use of wet etching (which forms the sloped sidewalls) as opposed to the use of plasma-etching (which produces straight sidewalls).

c. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the 1-D groove QGIP structure of Choi '015 by substituting 2-D groove structure as taught by Chen (thereby producing isolated columns) for the purpose of even further reducing the ratio of the detector area to the optical area and thereby increase the sensitivity as taught by Choi '015.

Further, Chen teaches that when using sidewalls formed by wet-etching, the performance of the 2-D QGIPs (detectors C and D) is inferior to that of the 1-D QGIPs (detectors A and B) because while the V-shaped grooves of the one groove direction are beneficial, the presence of the inverted V-shaped groove of the orthogonal direction reduces absorption (page 1435, col. 1). Chen also teaches that in order to fully exploit the potential of the QGIP, more effort is need to investigate how the coupling efficiency can be affected by various sidewall profiles, created by various etching methods (page 1436, col. 2). As such, it would have been further obvious to the skill artisan, when modifying the Choi '015 QGIP so as to form a 2-D groove QGIP, to specifically employ plasma etching as opposed to wet etching--and thereby form vertical sidewalls instead of slanted sidewalls--for the purpose of preventing the decrease in absorption efficiency that results from the inverted pyramid profile that is associated with the wet-etching process.

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d. Regarding claims 2 and 7 setting forth a plurality of separate metallic elements respectively formed over said plurality of quantum well structures, note for example FIGs 1a-c, wherein the bottom contact layer serves as the common contact, and a plurality (only one is depicted for clarity) of metal contacts are separately formed over respective, separate sections of plural quantum well structures.

5. Claims 4, 9 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Choi '015/Chen as applied to the claims above and further in view of Choi '469 (previously made of record). Choi '015 teaches that QGIPs are responsive to a broader range of wavelengths than QWIPS and can therefore be employed in multi-color detection applications (e.g., col. 8, lines 12-). Chen discloses that the C-QWIPs may be used for multicolor detection and expressly discloses an embodiment wherein a second QWIP is stacked upon a first QWIP by means of an interposed common contact layer; but therein the corrugations are only formed into the upper QWIP due to the large thickness of the combined QWIPs.

a. Choi '469 teaches that it was known to provide multi-color QWIPs wherein the respective wells for detecting the different wavelengths are interlaced, instead of forming one set on top of the other, thereby eliminating the intermediate third, common contact. It would have been obvious to one of ordinary skill in the art at the time of the invention to have employed a multicolor QGIP having the respective wavelength wells provided interlaced instead of formed in

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separate portions of the stack for the purpose of reducing the total thickness and simplifying the wiring requirements by eliminating the need for a third, common contact layer.

Response to Arguments

6. Applicant's arguments filed 5/12/2003 have been fully considered but they are moot in light of the new grounds of rejection.

Conclusion

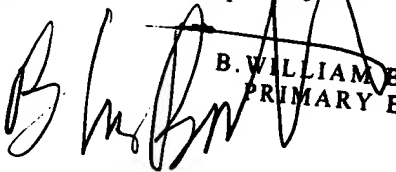
7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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INFORMATION ON HOW TO CONTACT THE USPTO

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to the examiner, **B. William Baumeister**, at **(703) 306-9165**. The examiner can normally be reached Monday through Friday, 8:30 a.m. to 5:00 p.m. If the Examiner is not available, the Examiner's supervisor, Mr. Eddie Lee, can be reached at (703) 308-1690. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.


B. WILLIAM BAUMEISTER
PRIMARY EXAMINER

B. William Baumeister

Primary Examiner, Art Unit 2815

July 25, 2003